SINGLE LINE SYMBOLS

200/5 (3) — CURRENT TRANSFORMER
(3) —COUNT REQUIRED
200/5 —RATIO

(3)35/1 — POTENTIAL TRANSFORMER
(3) —COUNT REQUIRED
35/1 —RATIO

(27V) PROTECTIVE RELAYS AS FOLLOWS:
- 25 SYNCHRONIZING OR SYNCHRONISM CHECK
- 27 UNDERVOLTAGE
- 32 DIRECTONAL POWER
- 40 FIELD FAILURE
- 46 PHASE BALANCE
- 50 INSTANTANEOUS OVERCURRENT
- 51 TIME OVERCURRENT
- (N) ZERO SEQUENCE
- 52 CIRCUIT BREAKER
- 59 OVERVOLTAGE
- 60V VOLTAGE BALANCE
- 65 GOVERNOR CONTROL
- 67V DIRECTIONAL OVERCURRENT VOLTAGE RESTRAINED
- 81 FREQUENCY
- 81U UNDERFREQUENCY
- 86 LOCKOUT
- 90 VAR/POWER FACTOR CONTROLLER BASLER 250-G

SENSORS AND DEVICES
- FSS FIRST START SENSOR
- ILS ISOCHRONOUS LOAD SHARING
- W WATT TRANSDUCER
- WM KW METER

SURGE ARRESTOR

MEDIUM VOLTAGE DRAWOUT CIRCUIT BREAKER

MEDIUM VOLTAGE AIR INTERRUPTER SWITCH

LOW/MEDIUM VOLTAGE STATIONARY MANUAL OR ELECTRICALLY OPERATED (E.O.) SWITCH

LOW/MEDIUM VOLTAGE STATIONARY FUSE

LOW VOLTAGE DRAWOUT CIRCUIT BREAKER

TRANSFORMER

NETWORK PROTECTOR

MEDIUM VOLTAGE TERMINATION

AUTOMATIC/MANUAL TRANSFER SWITCH

K KEY INTERLOCK

E ELECTRIC INTERLOCK

HEAVY LINE INDICATES WORK TO BE DONE

LIGHT LINE INDICATES EXISTING WORK TO REMAIN

DASHED LINE INDICATES FUTURE WORK NOT PART OF THIS CONTRACT, UNLESS OTHERWISE NOTED.

POWER & LIGHTING SYMBOLS

DUPLEX RECEPTACLE – 24" A.F.F., U.O.N.

$ SINGLE POLE TOGGLE SWITCH – 50" A.F.F., U.O.N.
- 3 –INDICATES 3-WAY
- a –INDICATES SWITCH IDENTIFICATION

CONDUIT RUN CONCEALED IN HUNG CEILING SPACE OR WALL

CONDUIT RUN CONCEALED IN SLAB OR FLOOR FILL

CONDUIT RUN EXPOSED AT CEILING OR WALLS.

CONDUIT TURNING UP

CONDUIT TURNING DOWN

J JUNCTION OR PULL BOX

FLUORESCENT INDUSTRIAL FIXTURE
- 3 –INDICATES CIRCUIT NUMBER
- a –INDICATES SWITCH IDENTIFICATION

INCANDESCENT FIXTURE

EXIT LIGHT – SHADING INDICATES LIT FACE(S)

ELECTRICAL PANEL (AS INDICATED)

T TRANSFORMER (AS INDICATED)

FUSED DISCONNECT SWITCH (600V, 3P, 30A, U.O.N.)

NON-FUSED DISCONNECT SWITCH

COMBINATION MAGNETIC MOTOR STARTER

HORSEPOWER RATED THERMAL SWITCH

GROUND

CASE GROUND

(FA) U.H. FORCED AIR UNIT HEATER

T THERMOSTAT

FIRE PROTECTION & EMERGENCY SYMBOLS

H HEAT DETECTOR

S SMOKE DETECTOR

IR INFRARED DETECTOR

PS PULL STATION, FAST MS-6

F AV AUDIO VISUAL ALARM

EMERGENCY POWER OFF PUSH-BUTTON

F HORN

F BELL

I INTERFACE MODULE, FAST MS00M

TC TERMINAL STRIP CABINET

SECURITY & ACCESS CONTROL SYMBOLS

CR CARD READER

DA DOOR ALARM

DR DOOR RELEASE

NOTE: DEVICES FOR SECURITY SYSTEM PROVIDED BY OWNER

ABBREVIATIONS

A	AMPERE
AA	AMBIENT AIR
AF	AMPERE FRAME SIZE
A.F.F.	ABOVE FINISHED FLOOR
AM	AMMETER
A.S., AS	AMP SWITCH
AT	AMPERE TRIP RATING
AV	AUDIO/VISUAL
BG	BELOW GRADE
C	CONDUIT, CONDUCTOR OR COIL
CB	CIRCUIT BREAKER
COAX	COAXIAL CABLE
CONT.	CONTROL
C.T., CT	CURRENT TRANSFORMER
dB	DECIBEL
DBC	DIRECT BUS CONNECTION
DEMO	DEMOLITION
DES	DIESEL
DISC	DISCONNECT (SAFETY SWITCH)
D.M., DM	DAMPER MOTOR
ESMC	ELECTRICAL SYSTEM MASTER CONTROLLER
ELEV	ELEVATION
EMT	ELECTRICAL METALIC CONDUIT (THINWALL)
EPO	EMERGENCY POWER OFF
F.A., FA	FIRE ALARM OR FAN FORCED AIR
FLUOR	FLUORESCENT
FP	FIREPROOF
FU	FUSE
F.S., FS	FIRESTOP OR FLOAT SWITCH
FVNR	FULL VOLTAGE NON-REVERSING (STARTER)
F.O.	FUEL OIL
G.D., GD	GROUND DETECTOR
GEN	GENERATOR
GL	GRADE LINE
GND	GROUND
GRC	GALVANIZED RIGID CONDUIT
H	HEAT
H.W.	HARDWIRE
H.B., HB	HEADER BOX
INC	INCANDESCENT
IR	INFRARED
J.B., JB	JUNCTION BOX
KI	KIRK KEY INTERLOCK
KS	KEY SWITCH
KVA	KILO VOLT AMPERES
KVAR	KILO VOLT AMPERES REACTANCE
KW	KILO WATTS
L.A.	LIGHTNING ARRESTOR
LMB	LOAD MANAGEMENT BAY
L.V., LV	LOW VOLTAGE (480V OR 120V)
M	MOTOR
MCM	THOUSAND CIRCULAR MILS
M.H., MH	MOUNTING HEIGHT
M.V., MV	MEDIUM VOLTAGE (15KV)
NG	NON-GROUNDED
P	POLE
P.B., PB	PULLBOX
PC	PROGRAMMABLE LOGIC CONTROLLER
PERM.	PERMISSIVE
P.F., PF	POWER FACTOR
PH., ø	PHASE
PMP	PUMP
PNL	PANEL
PR	PAIR
P.S., PS	PULLSTATION, PRESSURE SWITCH OR POWER SUPPLY
P.T., PT	POTENTIAL TRANSFORMER
R	RELAY
REAC	REACTOR
S	SMOKE
S.C., SC	STRESS CONE(S)
SEL SW	SELECTOR SWITCH
SH	SHIELDED
SOL	SOLENOID
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
T	TRANSFORMER
TB	TERMINAL BLOCK
T.D., TD	TIME DELAY
TEFC	TOTALLY ENCLOSED FAN COOLED
TERM	TERMINATION
TS	TEST SWITCH
TW	TWISTED
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
USS	UNIT SUBSTATION
V	VOLTS
VM	VOLTMETER
V.S., VS	VOLT SWITCH
W	WIRE
WP	WEATHERPROOF
Y	WYE

GENERAL NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE TO PERFORM ALL WORK NECESSARY TO FURNISH, OFFLOAD, STORE, STAGE, REMOVE AND INSTALL EQUIPMENT APPURTENANCES, MATERIALS AND SERVICES TO MAKE INSTALLATION COMPLETE, FUNCTIONAL AND OPERABLE TO THE SATISFACTION OF THE ENGINEER.
2. AS PART OF THIS CONTRACT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF CERTAIN EQUIPMENT, APPURTENANCES AND MATERIALS WHICH WILL BE FURNISHED BY THE PORT AUTHORITY (PA), AS DELINEATED ON THESE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT, VALVES, ACTUATORS, CONTROL WIRING, CONTROL DEVICES, RACKS, SUPPORTS, VIBRATION ISOLATORS, ETC. AS PER THE MANUFACTURERS/ VENDORS RECOMMENDATIONS.
3. THE CONTRACTOR SHALL INCORPORATE ALL PERTINENT INFORMATION OF THE PA FURNISHED EQUIPMENT IN HIS SHOP DRAWINGS AND SUBMIT TO THE ENGINEER FOR APPROVAL. SUCH INFORMATION SHALL INCLUDE BUT NOT LIMITED TO THE DIMENSIONS, LOCATIONS, CONNECTION DETAILS, INSTALLATION DETAILS, FUNCTIONS, CONTROLS, ELECTRICAL WIRING AND POWER REQUIREMENTS FOR EACH PIECE OF EQUIPMENT WIRING TERMINATIONS.
4. THE CONTRACTOR SHALL COORDINATE WITH THE VENDORS OF THE PA FURNISHED EQUIPMENT FOR THE PURPOSE OF DELIVERY, RIGGING AND PROPER HANDLING AND INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE TO ACQUIRE THE NECESSARY TECHNICAL SUPPORT FROM THE APPLICABLE MANUFACTURER(S) TO ENSURE PROPER INSTALLATION, TO SATISFY THE OPERATIONAL AND FUCTIONAL REQUIREMENTS OF ALL EQUIPMENT AND COMPONENTS INSTALLED BY HIM UNDER THIS CONTRACT.
5. THE CONTRACTOR SHALL INSPECT, AND IF ACCEPTABLE, APPROVE ALL EQUIPMENT AND MATERIALS PROVIDED BY THE PA PRIOR TO HANDLING, STORING AND INSTALLING.
6. REFER TO THE CONTRACT SPECIFICATIONS FOR THE LIST OF REFERENCE DOCUMENTS PERTAINING TO THE SPECIFICATIONS OF THE EQUIPMENT, APPURTENANCES AND MATERIALS FURNISHED BY THE PA.
7. THE CONTRACTOR SHALL ASSUME ALL RESPONSIBILITIES FOR THE LOSS OR DAMAGE OF ANY OF THE PA FURNISHED EQUIPMENT DUE TO HIS NEGLIGENCE. THE CONTRACTOR SHALL REPAIR OR REPLACE SUCH EQUIPMENT TO THE SATISFACTION OF THE ENGINEER, PLUS LIQUIDATED DAMAGES FOR ANY DELAY TO THE CONTRACT SCHEDULE RESULTED FROM THE LOSS OF DAMAGE.
8. THE CONTRACTOR SHALL SUBMIT DETAILED CONSTRUCTION PHASING PLAN PRIOR TO STARTING THE WORK TO BE PERFORMED UNDER THIS CONTRACT, INCLUDING THE METHODOLOGY FOR THE RIGGING OF MATERIAL AND EQUIPMENT. SUCH PLAN SHALL DETAIL ALL TEMPORARY STRUCTURES AND EQUIPMENT NECESSARY FOR THE PROPER HANDLING OF THE MATERIAL AND EQUIPMENT WITH THE RISK OF DAMAGING ANY STRUCTURE, EQUIPMENT OR PERSONNEL.
9. CONDUITS INSTALLED IN SHAFTS, CONCRETE ENVELOPES AND IN GARAGE EXHAUST PLENUM SPACES:
   - A) ALL WORK SCHEDULES MUST BE COORDINATED WITH THE PROJECTS CONSTRUCTION MANAGER.
   - B) PREMIUM TIME MAY BE REQUIRED WHERE SPACE ACCESS IS THROUGH TENANT AREAS. INSTALLATION NOISE IS OBJECTIONABLE, EXISTING SYSTEM SHUTDOWNS CANNOT BE TOLERATED DURING NORMAL WORKING HOURS AND ENVIRONMENTAL REQUIRING SPECIAL SUPERVISION.
   - C) IN DETERMINING HOW CONDUITS WILL BE INSTALLED IN VERTICAL SHAFTS AND CABLES PULLED TO DESIGNATED PULL AND SPLICE BOX LOCATIONS CONTRACTORS MUST COORDINATE WORK WITH THE ARCHITECT, STRUCTURAL ENGINEER AND THE PROJECTS CONSTRUCTION MANAGER. ACCESSIBILITY ON SOME FLOORS MAY BE MORE LIMITED THAN ON OTHERS. THE ACCESS PATH BETWEEN CONSTRUCTION STAGING AREAS AND INSTALLATION POINTS MUST BE COORDINATED WITH THE PROJECTS CONSTRUCTION MANAGER. SCAFFOLDING AND TEMPORARY WORKING PLATFORM INSTALLATIONS, WHERE REQUIRED BY THE CONTRACTOR, MUST BE COORDINATED AND APPROVED BY THE STRUCTURAL ENGINEER AND CONSTRUCTION MANAGER. WHERE ACCESS TO THE SHAFTS REQUIRED REMOVAL OF EXISTING WALL SECTIONS, CONTRACTOR SHALL INCLUDE RECONSTRUCTION OF WALL WITH SAME MATERIAL AND FINISH AND MAINTAIN THE REQUIRED RATINGS TO MEET CODE.
   - D) WHERE HORIZONTAL CONDUIT RUNS ARE INSTALLED IN A CONCRETE ENVELOPE, DETAILS OF INSTALLATION AND SUPPORTS FROM EXISTING STRUCTURES SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER.
   - E) CONTRACTOR MAY ELECT TO RELOCATE AND ADD TO THE PULLBOXES SHOWN AT BOTTOM OF SHAFTS AND IN HORIZONTAL RUNS TO FACILITATE PULLING. LOCATIONS MUST BE APPROVED BY THE CONSTRUCTION MANAGER.
10. CONTROL TERMINAL STRIP CABINETS SHALL CONTAIN TERMINATIONS FOR AUTOMATIC TRANSFER SWITCH REMOTE CONTROLS. AT STRIP CABINETS INDICATED ON DRAWINGS, INSTALL ON UPS MODULE AND OUTPUT TERMINALS TO POWER THREE (3) AUTOMATIC TRANSFER SWITCH CONTROL MODULES FROM THE STRIP CABINET. PROVISIONS FOR INSTALLATION OF UPS MODULES SHALL BE INCLUDED IN ALL OTHER STRIP CABINETS. THE WIRE QUANTITIES SHOWN ON DRAWING E1-02 REFLECT ONLY WIRING ALLOCATED FOR TRANSFER SWITCHES. ALL TERMINAL STRIP CABINETS SHALL HAVE A MINIMUM OF 25% SPARE TERMINALS. IN SOME RISERS, BECAUSE OF SPACE LIMITATIONS, CONTRACTOR SHALL INSTALL A PULLBOX IN THE SHAFT AND EXTEND WIRING TO A DESIGNATED LOCATION IN THE ADJACENT MECHANICAL ROOM.
11. MAINTAIN CONTINUITY OF ELECTRIC SERVICE TO ALL LIGHTING AND POWER CIRCUITS WHERE ALTERATION WORK EFFECTS EXISTING CIRCUITRY. TEMPORARY CIRCUIT SHUTDOWNS SHALL BE SCHEDULED WITH THE CONSTRUCTION MANAGER. INSTALLATION WORK SHALL CONFORM TO BUILDING STANDARDS.
12. CONTRACTOR SHALL PROVIDE TEMPORARY LIGHTING IN SHAFTS, AIR PLENUMS, ETC WHERE NECESSARY FOR INSTALLATION WORK AND PERSONNEL SAFETY. THE POWER SOURCE FOR TEMPORARY LIGHTING IN EACH AREA SHALL BE DESIGNATED BY THE CONSTRUCTION MANAGER.
13. TEMPORARY WIRING ROUTED IN TENANT SPACES, PUBLIC CORRIDORS, ETC SHALL BE PROTECTED FROM ACCIDENTAL CONTACT IN A MANNER APPROVED BY THE PA SAFETY OFFICER. TEMPORARY WIRING SHALL BE REMOVED WHEN NO LONGER NECESSARY FOR INSTALLATION WORK.
14. WIRE SOLENOID VALVE ON FUEL OIL LINE FROM HEADER ON EACH GENERATOR TO THE ENGINE START-STOP CIRCUIT. SEE DWG. M2-04
15. IN GENERAL, BULKHEAD CONTRACTOR SHALL PROVIDE AND INSTALL SENSORS ON 1" DRIP PANS AND WIRE TO THE BUILDING SCADA CONTROL AND MONITORING SYSTEM VIA INTERFACE MODULE. SEE DRAWING P2-04.
16. ALL MISCELLANEOUS CONTROL, INSTRUMENTATION AND SENSOR WIRING IN GENERATOR ROOM SHALL BE INSTALLED IN 1" RIGID STEEL CONDUIT MINIMUM WITH #12 OR #14 WIRES AS SPECIFIED BY DEVICE VENDOR.
17. WIRE FUEL GAUGES AND OVERFILL ALARMS ON B-2 LEVEL TO NEW FUEL MANAGEMENT SYSTEM PANEL (FMP). EXTEND WIRING IN RIGID STEEL CONDUIT FROM FMP TO ALARM LIGHT AND SHUTOFF DEVICE AT FUEL INPUT CONNECTION POINT ON EXTERIOR OF BUILDING. SEE DWGS. M1-01 AND M1-02. PROVIDE AUXILIARY CONTACTS AND CONNECT TO EXISTING BUILDING SCADA CONTROL AND MONITORING SYSTEM VIA INTERFACE MODULE.
18. WIRE LEAK DETECTOR IN RIGID STEEL CONDUIT AT BOTTOM OF OIL RISER SHAFT TO FMP. SEE DWG. M1-03.
19. ALL CONDUIT SHALL BE GALVANIZED RIGID STEEL.
20. 15KV RISER AND HORIZONTAL CABLES TO BE AUTHORITY FURNISHED EQUIPMENT FOR INSTALLATION UNDER THIS SCOPE OF WORK.

THE PORT AUTHORITY OF NY & NJ

CONFORMED DRAWING
08/3/98
SIGNED AND SEALED
COPY IS KEPT ON FILE

ORIGINAL SIGNED & SEALED BY N.Y. P.E. (OR R.A.)

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No	Date	Revision	Approved

Engineering Department
Design Divisions

The World Trade Center

File

STANDBY POWER
5 WORLD TRADE CENTER

ELECTRICAL

SYMBOL LIST & GENERAL NOTES

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FFP	MAR	
Designed by	Drawn by	Check by

Date 11/10/97 Scale NONE

Contract Number WTC-945.071 Drawing Number E0-01